Salt of the Earth: Ethylene Promotes Salt Tolerance by Enhancing Na/K Homeostasis

Too much salt can do terrible things to a plant. Dissolved in solution, salt reduces the availability of water to the plant. Also, excess Na in high-salinity soil competes with K for uptake across the plasma membranes of plant cells, reducing plant growth and causing cellular injury and even death. Indeed, salinity tolerance is correlated with the ability of a plant to retain proper tissue K levels. In addition, soil salinity stress causes in planta accumulation of reactive oxygen species (ROS), which can result in oxidative stress and cellular damage. Conversely, ROS also mediate plant salinity tolerance. For example, the ROS-producing protein RESPIRATORY BURST OXIDASE HOMOLOG F (RBOHF) plays a key role in soil salinity tolerance (Jiang et al., 2012). Under saline-soil conditions, Arabidopsis thaliana plants lacking RBOHF function exhibit high Na levels in their root stelar cells and xylem sap, enhanced root-to-shoot Na delivery, and high Na accumulation in shoots, adding up to soil salinity hypersensitivity. Other factors also regulate ionic homeostasis and plant salt tolerance. For example, salt-activated ethylene signaling regulates plant growth and development by altering the properties of the growth-repressing DELLA proteins (Achard et al., 2006). DELLA-independent pathways likely function in salt tolerance as well, but these pathways have remained unclear.


REFERENCES


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Identification of a soil salinity–tolerant mutant. The highlighted section shows a green soil salinity–tolerant mutant (arrow) among bleached, dead, and dying plants. (Reprinted from Jiang et al. 2013, Supplemental Figure 1.)

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